

## **Revised Graywater Standards**

On March 18, 1997, the Building Standards Commission approved the revised California Graywater Standards (attached Appendix G). The most significant change in the standards is that gray water systems can now be used in commercial, industrial, and multifamily projects, as well as single-family residences.

Other changes include: (1) that only one irrigation zone is now required (rather than the previous two); (2) filters are to be sized appropriately to maintain the filtration rate rather than the previously prescribed 1-inch filter; and (3) a new procedure for estimating gray water discharge has been added for commercial, industrial, and institutional projects.

## APPENDIX G

### GRAYWATER SYSTEMS

Title 24, Part 5, California Administrative Code

#### **G 1 Graywater Systems (General)**

(a) *The provisions of this Appendix shall apply to the construction, installation, alteration and repair of graywater systems for subsurface landscape irrigation. The graywater system shall not be connected to any potable water system without an air gap (~~a space or other physical device which prevents backflow~~) and shall not result in any surfacing of the graywater. Except as otherwise provided for in this Appendix, the provisions of the Uniform Plumbing Code (UPC) shall be applicable to graywater installations.*

(b) *The type of system shall be determined on the basis of location, soil type, and ground water level and shall be designed to accept all graywater connected to the system from the building. The system shall discharge into subsurface irrigation fields and may include surge tank(s) and appurtenances, as required by the Administrative Authority.*

(c) *No graywater system, or part thereof, shall be located on any lot other than the lot which is the site of the building or structure which discharges the graywater; nor shall any graywater system or part thereof be located at any point having less than the minimum distances indicated in Table G-1.*

(d) *No permit for any graywater system shall be issued until a plot plan with appropriate data satisfactory to the Administrative Authority has been submitted and approved. When there is insufficient lot area or inappropriate soil conditions for adequate absorption of the graywater, as determined by the Administrative Authority, no graywater system shall be permitted. The Administrative Authority is a city or county.*

(e) *No permit shall be issued for a graywater system which would adversely impact a geologically sensitive area, as determined by the Administrative Authority.*

(f) *Private sewage disposal systems existing or to be constructed on the premises shall comply with Appendix I of this code or applicable local ordinance. When abandoning underground tanks, Section 722.0 of the UPC shall apply. Also, appropriate clearances from graywater systems shall be maintained as provided in Table G-1. The capacity of the private sewage disposal system, including required future areas, shall not be decreased by the existence or proposed installation of a graywater system servicing the premises.*

(g) *Installers of graywater systems shall provide an operation and maintenance manual, acceptable to the Administrative Authority, to the owner of each system. Graywater systems require regular or periodic maintenance.*

(h) *The Administrative Authority shall provide the applicant a copy of this Appendix.*

#### **G 2 Definitions**

*Graywater is untreated waste water which has not come into contact with toilet waste. Graywater includes waste water from bathtubs, showers, bathroom wash basins, clothes washing machines, and laundry tubs, or an equivalent discharge as approved by the*

*Administrative Authority. It does not include waste water from kitchen sinks, photo lab sinks, dishwashers, or laundry water from soiled diapers.*

*Surfacing of graywater means the ponding, running off, or other release of graywater from the land surface.*

### **G 3 Permit**

*It shall be unlawful for any person to construct, install or alter, or cause to be constructed, installed or altered any graywater system in a building or on premises without first obtaining a permit to do such work from the Administrative Authority.*

### **G 4 Drawings and Specifications**

*The Administrative Authority may require any or all of the following information to be included with or in the plot plan before a permit is issued for a graywater system:*

*(a) Plot plan drawn to scale completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of all present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and 100 percent expansion area or building sewer connecting to public sewer, and location of the proposed graywater system.*

*(b) Details of construction necessary to ensure compliance with the requirements of this Appendix together with full description of the complete installation including installation methods, construction and materials as required by the Administrative Authority.*

*(c) A log of soil formations and ground water level as determined by test holes dug in close proximity to any proposed irrigation area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests. In lieu of percolation tests, the Administrative Authority may allow the use of Table G-2, an infiltration rate designated by the Administrative Authority, or an infiltration rate determined by a test approved by the Administrative Authority.*

*(d) A characterization of the graywater for commercial, industrial, or institutional systems, based on existing records or testing.*

### **G 5 Inspection and Testing**

*(a) Inspection*

*(1) All applicable provisions of this Appendix and of Section 103.5 of the UPC shall be complied with.*

*(2) System components shall be properly identified as to manufacturer.*

*(3) Surge tanks shall be installed on dry, level, well-compacted soil if in a drywell, or on a level, three inch concrete slab or equivalent, if above ground.*

*(4) Surge tanks shall be anchored against overturning*

*(5) If the irrigation design is predicated on soil tests, the irrigation field shall be installed at the same location and depth as the tested area.*

*(6) Installation shall conform with the equipment and installation methods identified in the approved plans.*

(7) Graywater stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping. Stub-out shall be permanently marked "GRAYWATER STUB-OUT, DANGER UNSAFE WATER."

(b) *Testing*

(1) Surge tanks shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain watertight.

(2) A flow test shall be performed through the system to the point of graywater irrigation. All lines and components shall be watertight.

**G-6 Procedure for Estimating Graywater Discharge**

(a) *Single Family Dwellings and Multi-Family Dwellings*

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records, or calculations of local daily per person interior water use:

1. The number of occupants of each dwelling unit shall be calculated as follows:

First Bedroom	2 occupants
Each additional bedroom	1 occupant

2. The estimated graywater flows of each occupant shall be calculated as follows:

Showers, bathtubs and wash basins	25 GPD/occupant
Laundry	15 GPD/occupant

3. The total number of occupants shall be multiplied by the applicable estimated graywater discharge as provided above and the type of fixtures connected to the graywater system.

(b) *Commercial, Industrial, and Institutional Projects*

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records, or other documentation to estimate graywater discharge:

1. The square footage of the building divided by the occupant load factor from UPC Table 10-A equals the numbers of occupants.

2. The number of occupants times the flow rate per person (minus toilet water and other disallowed sources) from UPC Table I-2 equals the estimated graywater discharge per day.

The graywater system shall be designed to distribute the total amount of estimated graywater discharged daily.

**G 7 Required Area of Subsurface Irrigation**

Each irrigation zone shall have a minimum effective irrigation area for the type of soil and infiltration rate to distribute all graywater produced daily, pursuant to Section G-6, without surfacing. The required irrigation area shall be based on the estimated graywater discharge, pursuant to Section G-6, size of surge tank, or a method determined by the Administrative Authority.

If a mini-leachfield irrigation system is used, the required square footage shall be determined from Table G-2, or equivalent, for the type of soil found in the excavation.

*The area of the irrigation field shall be equal to the aggregate length of the perforated pipe sections within the irrigation zone times the width of the proposed mini-leachfield trench.*

*No irrigation point shall be within five vertical feet of the highest known seasonal groundwater nor where graywater may contaminate the groundwater or ocean water. The applicant shall supply evidence of ground water depth to the satisfaction of the Administrative Authority.*

## **G 8 Determination of Irrigation Capacity**

*(a) In order to determine the absorption quantities of soils other than those listed in Table G-2, the proposed site may be subjected to percolation tests acceptable to the Administrative Authority or determined by the Administrative Authority.*

*(b) When a percolation test is required, no mini-leach field system or subsurface drip irrigation system shall be permitted if the test shows the absorption capacity of the soil is less than 60 minutes/inch or more rapid than 5 minutes/inch, unless otherwise permitted by the Administrative Authority.*

*(c) The irrigation field size may be computed from Table G-2, or determined by the Administrative Authority or a designee of the Administrative Authority.*

## **G 9 Surge Tank Construction (Figure 1)**

*(a) Plans for surge tanks shall be submitted to the Administrative Authority for approval. The plans shall show the data required by the Administrative Authority and may include dimensions, structural calculations, and bracing details.*

*(b) Surge tanks shall be constructed of solid, durable materials, not subject to excessive corrosion or decay and shall be watertight.*

*(c) Surge tanks shall be vented as required by Chapter 9 of this Code and shall have a locking, gasketed access opening, or approved equivalent, to allow for inspection and cleaning.*

*(d) Surge tanks shall have the rated capacity permanently marked on the unit. In addition, "GRAYWATER IRRIGATION SYSTEM, DANGER - UNSAFE WATER" shall be permanently marked on the surge tank.*

*(e) Surge tanks installed above ground shall have an overflow, separate from the line connecting the tank with the irrigation fields. The overflow shall have a permanent connection to a sewer or to a septic tank, and shall be protected against sewer line backflow by a backwater valve. The overflow shall not be equipped with a shut-off valve.*

*(f) The overflow and drain pipes shall not be less in diameter than the inlet pipe. The vent size shall be based on the total graywater fixture units, as outlined in UPC Table 7-5 or local equivalent. Unions or equally effective fittings shall be provided for all piping connected to the surge tank.*

*(g) Surge tanks shall be structurally designed to withstand anticipated loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot when the tank is designed for underground installation.*

*(h) Surge tanks may be installed below ground in a dry well on compacted soil, or buried if the tank design is approved by the Administrative Authority. The system shall be*

*designed so that the tank overflow will gravity drain to a sanitary sewer line or septic tank. The tank must be protected against sewer line backflow by a backwater valve.*

*(i) Materials*

*(1) Surge tanks shall meet nationally recognized standards for non potable water and shall be approved by the Administrative Authority.*

*(2) Steel surge tanks shall be protected from corrosion, both externally and internally, by an approved coating or by other acceptable means.*

## **G 10 Valves and Piping (Figure 1)**

*Graywater piping discharging into a surge tank or having a direct connection to a sanitary drain or sewer piping shall be downstream of an approved waterseal type trap(s). If no such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from any possible waste or sewer gasses. Vents and venting shall meet the requirements in Chapter 9 of the UPC. All graywater piping shall be marked or shall have a continuous tape marked with the words "DANGER - UNSAFE WATER." All valves, including the three-way valve, shall be readily accessible and shall be approved by the Administrative Authority. A backwater valve, installed pursuant to this Appendix, shall be provided on all surge tank drain connections to the sanitary drain or sewer piping.*

## **G 11 Irrigation Field Construction**

*The Administrative Authority may permit subsurface drip irrigation, mini-leach field or other equivalent irrigation methods which discharge graywater in a manner which ensures that the graywater does not surface. Design Standards for subsurface drip irrigation systems and mini-leach field irrigation systems follow:*

*(a) Standards for a subsurface drip irrigation system are:*

*(1) Minimum 140 mesh (115 micron) filter with a capacity of 25 gallons per minute, or equivalent, filtration, sized appropriately to maintain the filtration rate, shall be used. The filter back-wash and flush discharge shall be caught, contained and disposed of to the sewer system, septic tank, or with approval of the Administrative Authority, a separate mini-leach field sized to accept all the back wash and flush discharge water. Filter backwash water and flush water shall not be used for any purpose. Sanitary procedures shall be followed when handling filter back-wash and flush discharge of graywater.*

*(2) Emitters shall have minimum flow path of 1200 microns and shall have a coefficient of manufacturing variation (Cv) of no more than seven percent. Irrigation system design shall be such that emitter flow variation shall not exceed plus or minus ten percent. Emitters shall be recommended by the manufacture for subsurface use and graywater use, and shall have demonstrated resistance to root intrusion. For emitter ratings refer to: Irrigation Equipment Performance Report, Drip Emitters and Micro-Sprinklers, Center for Irrigation Technology, California State University, 5730 N. Chestnut Avenue. Fresno, California 93740-0018.*

- (3) Each irrigation zone shall be designed to include no less than the number of emitters specified in Table G-3, or through a procedure designated by the Administrative Authority. Minimum spacing between emitters is 14 inches in any direction.
- (4) The system design shall provide user controls, such as valves, switches, timers, and other controllers as appropriate, to rotate the distribution of graywater between irrigation zones.
- (5) All drip irrigation supply lines shall be polyethylene tubing or PVC class 200 pipe or better and schedule 40 fittings. All joints shall be properly solvent-cemented, inspected and pressure tested at 40 psi, and shown to be drip tight for five minutes, before burial. All supply lines will be buried at least eight inches deep. Drip feeder lines can be poly or flexible PVC tubing and shall be covered to a minimum depth of nine inches.
- (6) Where pressure at the discharge side of the pump exceeds 20 pounds per square inch (psi), a pressure reducing valve able to maintain downstream pressure no greater than 20 psi shall be installed downstream from the pump and before any emission device.
- (7) Each irrigation zone shall include a flush valve/anti-siphon valve to prevent back siphonage of water and soil.
- (b) Standards for a mini-leach field system are:
- (1) Perforated sections shall be a minimum 3-inch diameter and shall be constructed of perforated high density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the graywater in the trench area. Material, construction and perforation of the piping shall be in compliance with the appropriate absorption field drainage piping standards and shall be approved by the Administrative Authority.
- (2) Clean stone, gravel, or similar filter material acceptable to the Administrative Authority, and varying in size between 3/4 inch to 2 inches shall be placed in the trench to the depth and grade required by this Section. Perforated sections shall be laid on the filter material in an approved manner. The perforated sections shall then be covered with filter material to the minimum depth required by this Section. The filter material shall then be covered with landscape filter fabric or similar porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspections and acceptance.
- (3) Irrigation fields shall be constructed as follows:

	<b>Minimum</b>	<b>Maximum</b>
<i>Number of drain lines per irrigation zone</i>	<i>1</i>	<i>---</i>
<i>Length of each perforated line</i>	<i>---</i>	<i>100 feet</i>
<i>Bottom width of trench</i>	<i>6 inches</i>	<i>18 inches</i>
<i>Total depth of trench</i>	<i>17 inches</i>	<i>18 inches</i>
<i>Spacing of lines, center to center</i>	<i>4 feet</i>	<i>---</i>
<i>Depth of earth cover of lines</i>	<i>9 inches</i>	<i>---</i>
<i>Depth of filter material cover of lines</i>	<i>2 inches</i>	<i>---</i>
<i>Depth of filter material beneath lines</i>	<i>3 inches</i>	<i>---</i>
<i>Grade of perforated lines</i>	<i>level</i>	<i>3 inches/100 feet</i>

## **G 12 Special Provisions**

- (a) *Other collection and distribution systems may be approved by the Administrative Authority as allowed by Section 301 of the UPC.*
- (b) *Nothing contained in this Appendix shall be construed to prevent the Administrative Authority from requiring compliance with stricter requirements than those contained herein, where such stricter requirements are essential in maintaining safe and sanitary conditions or from prohibiting graywater systems. The prohibition of graywater systems or more restrictive standards may be adopted by the Administrative Authority by ordinance after a public hearing.*

## **G 13 Health and Safety**

- (a) *Graywater may contain fecal matter as a result of bathing and/or washing of diapers and undergarments. Water containing fecal matter, if swallowed, can cause illness in a susceptible person. Therefore, graywater shall not be contacted by humans, except as required to maintain the graywater treatment and distribution system.*
- (b) *Graywater shall not include laundry water from soiled diapers.*
- (c) *Graywater shall not be applied above the land surface or allowed to surface and shall not be discharge directly into or reach any storm sewer system or any water of the United States.*
- (d) *Graywater shall not be used for vegetable gardens.*

**Table G-1 Location of Graywater System.**

<b>Minimum Horizontal Distance (in feet) From</b>	<b>Surge Tank (feet)</b>	<b>Irrigation Field (feet)</b>
<i>Buildings or Structures (1)</i>	<i>5ft (2)</i>	<i>8ft (3)</i>
<i>Property line adjoining private property</i>	<i>5ft</i>	<i>5ft (4)</i>
<i>Water supply wells (5)</i>	<i>50ft</i>	<i>100ft</i>
<i>Streams and lakes (5)</i>	<i>50ft</i>	<i>50ft</i>
<i>Seepage pits or cesspools</i>	<i>5ft</i>	<i>5ft</i>
<i>Disposal field &amp; 100% expansion area</i>	<i>5ft</i>	<i>4ft (6)</i>
<i>Septic tank</i>	<i>0ft</i>	<i>5ft (7)</i>
<i>On-site domestic water service line</i>	<i>5ft</i>	<i>5ft (8)</i>
<i>Pressure public water main</i>	<i>10ft</i>	<i>10ft (9)</i>
<i>Water ditches</i>	<i>50ft</i>	<i>50ft</i>

**Notes:** *When mini-leach fields are installed in sloping ground, the minimum horizontal distance between any part of the distribution system and ground surface shall be fifteen feet.*

*(1) Including porches and steps, whether covered or uncovered, but does not include car ports, covered walks, driveways and similar structures.*

*(2) The distance may be reduced to zero feet for above ground tanks if approved by the Administrative Authority.*

*(3) The distance may be reduced to two feet.*

*(4) For subsurface drip irrigation systems, 2 feet from property line.*

*(5) Where special hazards are involved, the distance may be increased by the Administrative Authority.*

*(6) Applies to the mini-leach fields type system only. Plus two feet for additional foot of depth in excess of one foot below the bottom of the drain line.*

*(7) Applies to mini-leach field only.*

*(8) A two foot separation is required for subsurface drip systems.*

*(9) For parallel construction or for crossings, approval by the Administrative Authority shall be required.*

**Table G-2 Mini-Leach Field Design Criteria of Six Typical Soils.**

<b>Type of Soil</b>	<b>Minimum sq. ft. of irrigation area per 100 gallon of estimated graywater discharge per day</b>	<b>Maximum absorption capacity, minutes per inch of irrigation area for a 24-hour period</b>
1. <i>Coarse sand or gravel</i>	20	5
2. <i>Fine sand</i>	25	12
3. <i>Sandy loam</i>	40	18
4. <i>Sandy clay</i>	60	24
5. <i>Clay with considerable sand or gravel</i>	90	48
6. <i>Clay with small amount of sand or gravel</i>	120	60

**Table G-3 Subsurface Drip Design Criteria of Six Typical Soils.**

<b>Type of Soil</b>	<b>Maximum emitter discharge (gal/day)</b>	<b>Minimum number of emitters per gpd of graywater production</b>
1. <i>Sand</i>	1.8	0.6
2. <i>Sandy loam</i>	1.4	0.7
3. <i>Loam</i>	1.2	0.9
4. <i>Clay loam</i>	0.9	1.1
5. <i>Silty clay</i>	0.6	1.6
6. <i>Clay</i>	0.5	2.0

*Use the daily graywater flow calculated in Section G-6 to determine the number of emitters per line.*

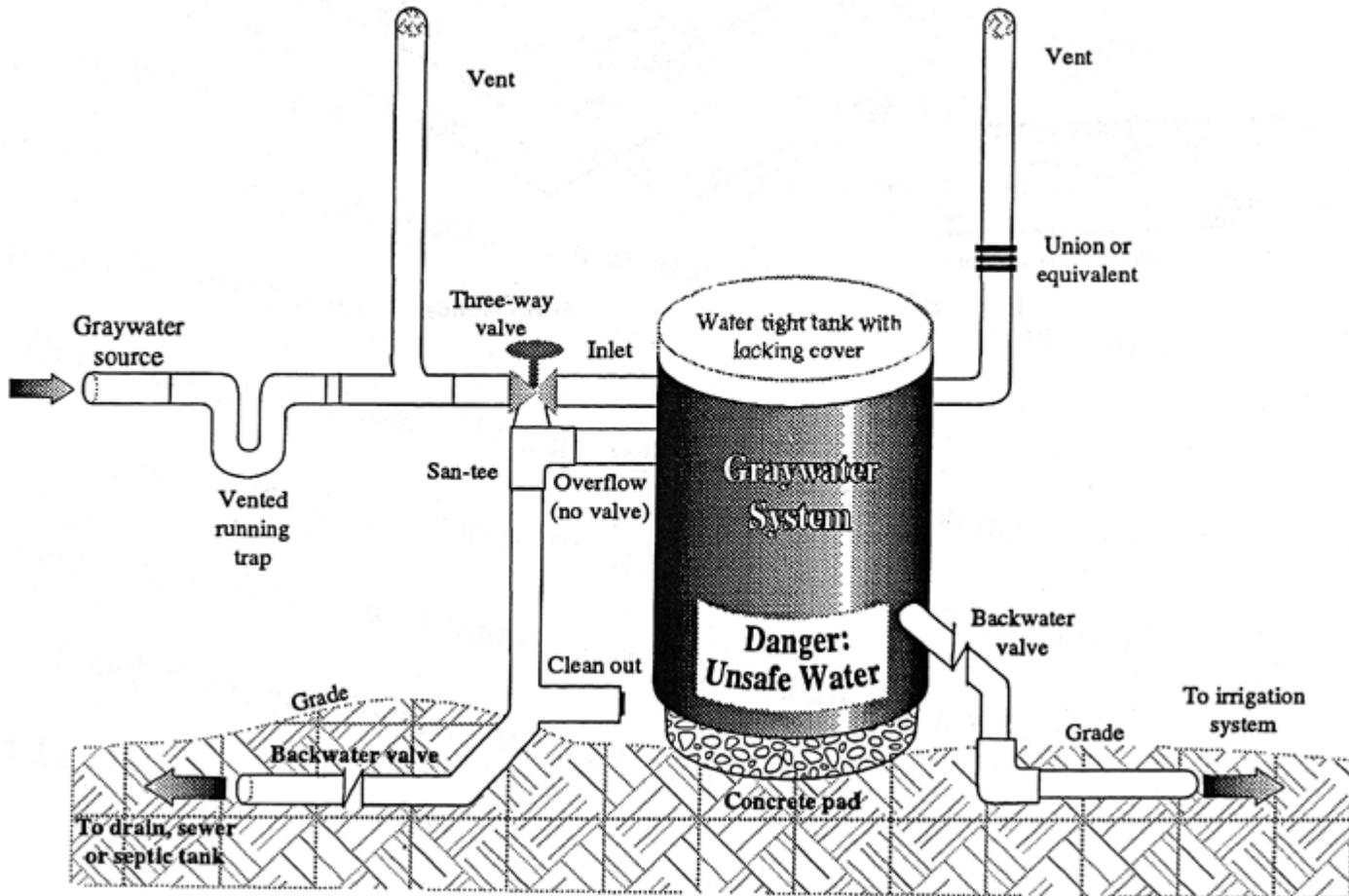


Figure 1-Graywater System Single Tank-Gravity (conceptual)

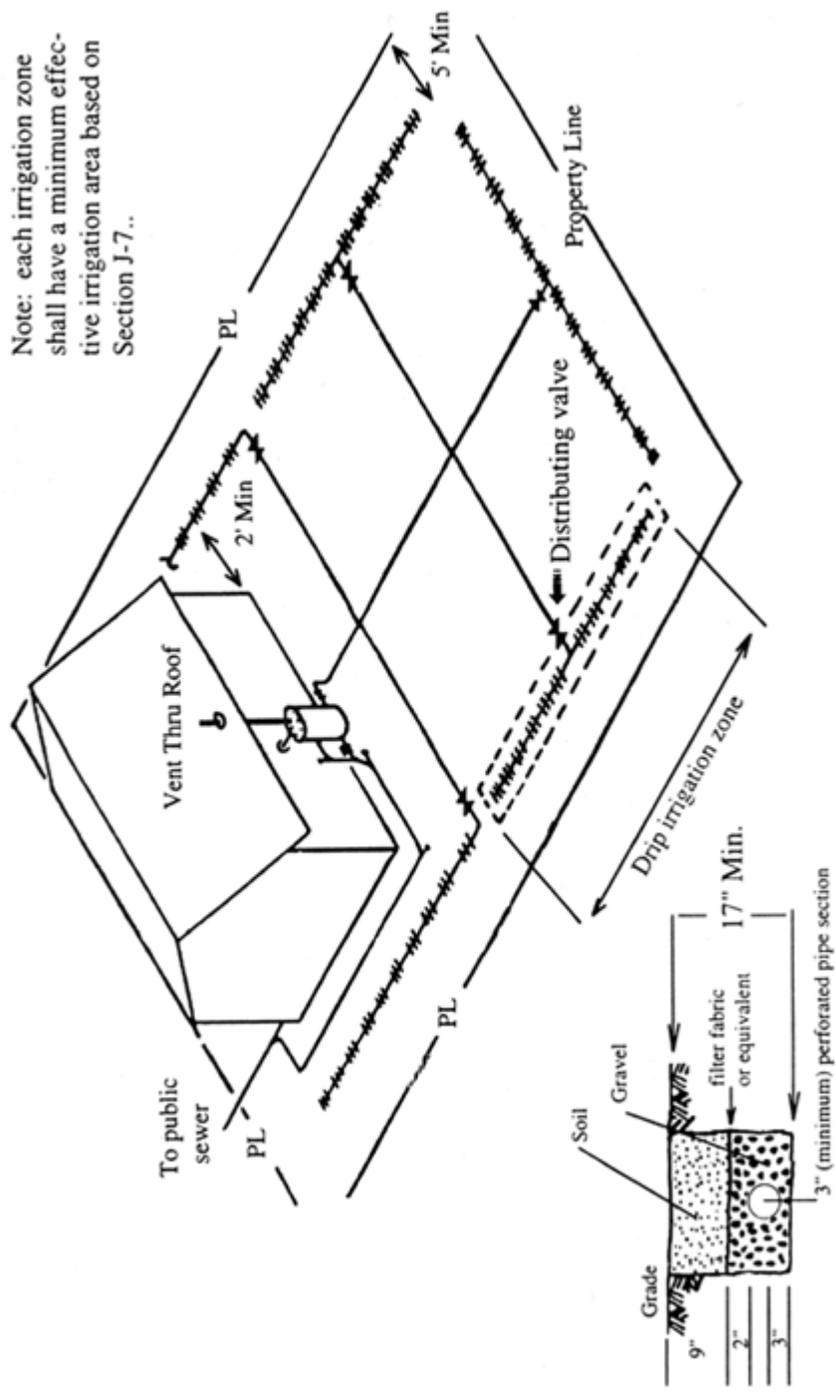


Figure 2-Graywater System Irrigation Layout (conceptual)